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"HISTORY OF THE XW-35 WARHEAD (u)"

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Weapon Systems

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XW-35-X1 WARHEAD

(b)(1), (b)(3)

XW-35-X1 Warhead - Cross Section

Timetable of XW-35 Events

1/7/52	Military Liaison Committee requests Division of Military Application to make a feasibility study of a warhead for the ATLAS intercontinental ballistic missile.

(b)(1), (b)(3)

10/20/54	Division of Military Application requests Los Alamos Scientific Laboratory, University of California Radiation Laboratory, and Sandia to study a suitable warhead design for ATLAS.
1/27/55	Air Materiel Command requests Sandia to submit proposal for ballistic-missile warhead fuze.
3/1/55	Sandia proposes two-phase approach to fuze design.
5/3/55	Air Research and Development Command requests Sandia to proceed with fuze design.
7/55	Authorization issued for feasibility study of thermonuclear warhead for an intercontinental ballistic missile.
9/9/55	Sandia notifies Santa Fe Operations Office that the XW-35 Warhead can be produced by the fall of 1959.
11/29/55	Sandia forwards ATLAS fuze proposal to Air Research and Development Command.
2/28/56	Military Liaison Committee releases set of military characteristics for a warhead compatible with ATLAS, THOR and JUPITER missiles.
3/1/56	Military Liaison Committee requests development of above warhead.

(b)(1), (b)(3)

7/18/56	Albuquerque Operations Office authorizes production of XW-35 for ATLAS, TITAN, THOR and JUPITER missiles.
12/6/56	Air Research and Development Command requests increase in yield of XW-35.

studies of a suitable warhead for the ATLAS, which had the most severe environment.

(b)(1), (b)(3)

The ATLAS missile had a maximum diameter of 10 feet, length of 75 feet, and blastoff weight of 243,300 pounds. Its booster engines possessed a total thrust of 300,000 pounds, and its sustainer engine a thrust of 60,000 pounds. The TITAN had a maximum diameter of 10 feet, length of 90 feet, and weighed 222,400 pounds. It had the same booster and sustainer engine thrusts. The THOR had a diameter of 8 feet, length of 62-1/2 feet, and gross weight of 110,400 pounds. It had one main engine with a thrust of 150,000 pounds. The JUPITER had a diameter of 8-3/4 feet, length of 58 feet, weight of 105,000 pounds, and the same thrust as the THOR.[5]

Air Materiel Command wrote to Sandia January 27, 1955, referring to Sandia's background in fuzing-system design, and requesting a fuze proposal for a ballistic-missile warhead.[6] Sandia replied March 1, 1955, suggesting a two-phase approach. Phase I would be a study of fuzing techniques and characteristics for a ballistic-missile environment, and Phase II would be development of a specific fuze.[7] Subsequently, Sandia was requested to design a fuze for the ATLAS. This would detonate the warhead at or near the surface of the target, to produce high contamination.[8]

(b)(1), (b)(3)

Accordingly, in July 1955, authorization was issued to study the feasibility of developing a thermonuclear warhead for an intercontinental ballistic missile. Due to the program urgency and the desire for the highest yield possible in a given weight, both Los Alamos and the Radiation Laboratory were requested to participate.

Sandia notified Santa Fe Operations Office September 9, 1955 that warhead designs could be firmed up by late 1957, with flight tests starting in early 1958.

Subsequently, the military characteristics for the Army's JUPITER warhead were approved by the Military Liaison Committee.

(b)(3)

Maximum yield and minimum weight were desired.[16]

The Division of Military Application was notified June 8, 1956 that early ATLAS and THOR missiles would be compatible with the same nose cone and warhead combination, and it was felt that this assembly could be applied to the TITAN. There was some question that any warhead optimized for the fairly blunt, thick nose being developed for ATLAS and THOR would also be best for the light glass ceramic nose cone of the JUPITER, even assuming that physical size and shape were identical. It was felt that full-scale tests might be required before any clear answer became evident.[17]

(b)(1), (b)(3)

The warhead would be carried by ATLAS,

TITAN and THOR missiles, and also the JUPITER, if this was possible without compromising the other designs.[19]

(b)(1), (b)(3)

This would provide a warhead for the ATLAS, THOR and JUPITER by their operational dates, and a warhead for TITAN well before its ready date. The University of California Radiation Laboratory would develop the XW-38, a higher yield and heavier warhead, for a later operational date.[20]

A composite warhead configuration was evolved to allow use of either the 20-inch-diameter XW-35 or the larger XW-38 with a common mounting flange. In the ATLAS and THOR nose cones, arming and fuzing components and attitude-control mechanism would be mounted in the annular space around the warhead. In the TITAN nose cone, the warhead would be mounted close to the front face, and this might involve heating problems. It would also have to be determined that weapon detonation would occur prior to nose deformation in contact bursts.[3]

The ATLAS, THOR and TITAN nose cones used copper heat sinks to distribute the heat throughout the nose-cone metal, which was expected to attain a temperature of about 1700°F. The JUPITER nose cone would be coated with a layer of fiberglass which would partially burn off during re-entry. This would physically remove heated material and it was hoped that the insulating properties of the fiberglass would help to keep the warhead compartment cool.[3]

Since it was felt that an antiballistic missile system might be in operation by 1960, the scheduled operational date for most of the missiles, it was desired that the warhead be made radiation-insensitive. This precluded use of transistors, diodes and similar devices. The warhead would be sealed and require a minimum of field testing. Monitoring would be accomplished through nose cone and missile consoles.[3]

The entire firing system would be potted, for adaptability to reduced pressures at high altitudes. The system would require three arming signals and either

October 1958. The warhead would be contained inside the nose cone, which would separate from the rest of the missile about 5 minutes after launch and then proceed along a ballistic trajectory to the impact point. Fuzing operations would occur upon re-entry into the atmosphere.[24]

The Assistant Secretary of Defense wrote to the Atomic Energy Commission March 29, 1957, noting that it was important that the ATLAS warhead yield be as large as possible within the prescribed weight limitations.

(b)(1), (b)(3)

The October 1958 operational availability date was to be retained at all costs.[25]

Report SC3995(TR), Proposed Ordnance Characteristics of the XW-35 Warhead, was discussed in the April 24, 1957 meeting of the Special Weapons Development Board.[26] The report proposed that a two-phase program be followed to provide a 20-inch version of the XW-35 for early operational capability and a higher yield version at a later date.[5] With the understanding that the XW-35 Mod 0 would be provided for initial use, the report was approved and forwarded to the Division of Military Application July 11, 1957.[27]

(b)(1), (b)(3)

the components.

(b)(3)

The main case and aft section would be sealed and pressurized to provide environmental protection during storage and operation. The firing system would be tested and certified at time of manufacture, and the warhead would require only continuity and pressure testing in the field or stockpile. There would be no field replacement of components and no need to break the warhead seal while the weapon was in military custody. The warhead would be provided with desiccant at the time of assembly to assure a low moisture content.

(b)(3)

Some suggestions had previously been made that emergency-capability warheads be provided. Thus, November 8, 1956, the Division of Military Application notified Albuquerque Operations Office that, as a result of a series of successful JUPITER tests, the Army was considering acceleration of this missile program.[31] Some attention was subsequently given to use of either XW-28 or XW-35.[32]

The same request was made, February 19, 1957, on behalf of the THOR.[33] Later, in August 1957, the JUPITER warhead emergency-capability program was cancelled.[34] However, December 2, 1957, the Military Liaison Committee noted that the Department of Defense was again accelerating the intermediate-range ballistic missile program. Both THOR and JUPITER squadrons, each requiring 15 missiles, would be operational by late 1958.

(b)(3)

In May 1958 it was decided that emergency-capability warheads for intermediate-range ballistic missiles would be supplied by XW-49 Warheads, which were

XW-28-Y1's modified to suit size and weight requirements. The emergency-capability units for the intercontinental ballistic missiles would be hand-built models of the XW-35-X1 and would be available by April 1959.[36]

Sandia wrote to the Division of Military Application May 5, 1958, nothing that considerable concern had been expressed over the safety of sealed-pit warheads.

(b)(3), (b)(1)

It had been suggested that an environmental sensing device be incorporated in the warhead electrical system to prevent detonation by any chance application of the sequence of electrical input signals. Study was being made of a single device that could be used with both missiles and bombs. The nose-cone re-entry deceleration formed a unique and common environment experienced prior to weapon detonation, and it was proposed that this deceleration pulse be used to close an inertial switch.

In the XW-35-X1 system, assembly of two such switches would be cross-connected and potted into a firing-set package. Production tests through warhead acceptance level would be accomplished by actuating the inertial switches on a centrifuge that would duplicate the re-entry environment, and electrical resets would be provided to return the switches to the safe position.[37]

(b)(1), (b)(3)

(b)(1), (b)(3)

Report SC4160(TR), Design Status of the XW-35-X1 Program at Cancellation, was published in August 1958 and was the termination report of the program.[39]

Glossary of XW-35 Terms

Air Force Ballistic Missile Division -- A division of the Air Force concerned with design and production of ballistic missiles.

Air Research and Development Command -- Established January 1950 by the Air Force to supervise efforts toward the accomplishment of the Air Force mission.

Albuquerque Operations Office -- Change of name for Santa Fe Operations Office, effective April 2, 1956.

Armed Forces Special Weapons Project -- An interdepartmental agency formed to handle military functions related to atomic weapons.

Arming Components -- Those weapon components which "arm" the weapon, i.e., prepare it for firing.

Army Ballistic Missile Agency -- That part of the Army concerned with the design and production of ballistic missiles.

Assistant Secretary of Defense -- Created by Department of Defense directive June 30, 1953 as part of DOD reorganization. Handles research and development activities of the DOD.

Ballistic Missiles -- Long-range missiles which are given a high initial velocity and then travel on a ballistic course to the target.

Baroswitch -- A switch actuated by air pressure.

Boosting -- The technique of increasing the yield of an implosion device by introducing deuterium-tritium gas into the implosion process.

Castle -- A full-scale test series held at the Pacific Proving Grounds. Series of six tests, starting March 1, 1954 and ending May 14, 1954.

Department of Defense -- The Armed Forces, i.e., the Army, Navy and Air Force.

Depleted Uranium -- Natural uranium from which most of the uranium-235 has been removed, leaving the uranium-238.

Development Program Definition -- A report that describes the weapon to be designed and the steps that will be taken in its development.

Division of Military Application -- An AEC office that functions as liaison between the Military and weapons designers and producers.

Emergency-Capability Program -- A weapons program to provide models of a given weapon design in advance of regular production.

Environmental Sensing Device -- A device that reacts to a specific environment of the weapon, such as speed, acceleration, altitude, etc.

(b)(3), (b)(1)

Fuzing Components -- Those weapon components that form the "fuze" of the weapon. A combination of the arming components and the firing devices that detonate the weapon at the correct time or place.

(b)(1), (b)(3)

Hardtack -- A nuclear series of 72 tests. Hardtack I was held at the Pacific Proving Grounds from April 28 to August 18, 1958. The decision to declare a moratorium on testing resulted in Hardtack II, held at the Nevada Test Site between September 12 and October 30, 1958.

Heat Sink -- A heavy mass of metal located in or near the nose cone of a ballistic missile. Has the function of absorbing the heat created when the nose cone re-enters the earth's atmosphere and heats up by skin friction with the air.

Implosion -- The effect created when a sphere of high explosive is detonated on its exterior surface. If suitable lens charges are provided, the force of the shock wave is directed largely toward the center of the sphere.

Inertial Switch -- A switch containing a small weight and a spring. When subjected to an external force of acceleration or deceleration, the weight compresses the spring. Generally, a metering device is added to measure the length of time the external force is applied.

Pit -- The hollow metal sphere at the center of an implosion bomb which receives the nuclear capsule when it is inserted.

Plumbbob -- A less-than-full-scale test series conducted at the Nevada Test Site. Series of 29 tests, starting May 28 and ending October 7, 1957.

Potting -- A means for improving the shock resistance of any item by embedding it in a plastic compound.

Primary -- A fission bomb that acts as the source of emergy to start the secondary, or thermonuclear, reaction of a two-stage bomb.

Proton -- The nucleus of the atom of the light isotope of hydrogen. It has a unit positive charge of electricity.

Redwing -- A full-scale test series held at the Pacific Proving Grounds. Series of 17 tests, starting May 4 and ending July 21, 1956.

Re-entry Shock -- The shock produced when a missile re-enters the earth's atmosphere.

(b)(1), (b)(3)

(b)(1), (b)(3)

<u>Uranium-235</u> -- A radioactive element, an isotope of uranium-238.

<u>Uranium-238</u> -- A radioactive element, atomic number 92. Natural uranium contains about 99.3 percent uranium-238; the rest is uranium-235.

<u>Warhead</u> -- A weapon carried to the target by missile.

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2.

3. (b)(3)

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(b)(3)

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22.

(b)(3)

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